PlantVisorPRO

Software Development Kit

GB

User manual

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READ AND SAVE THESE INSTRUCTIONS

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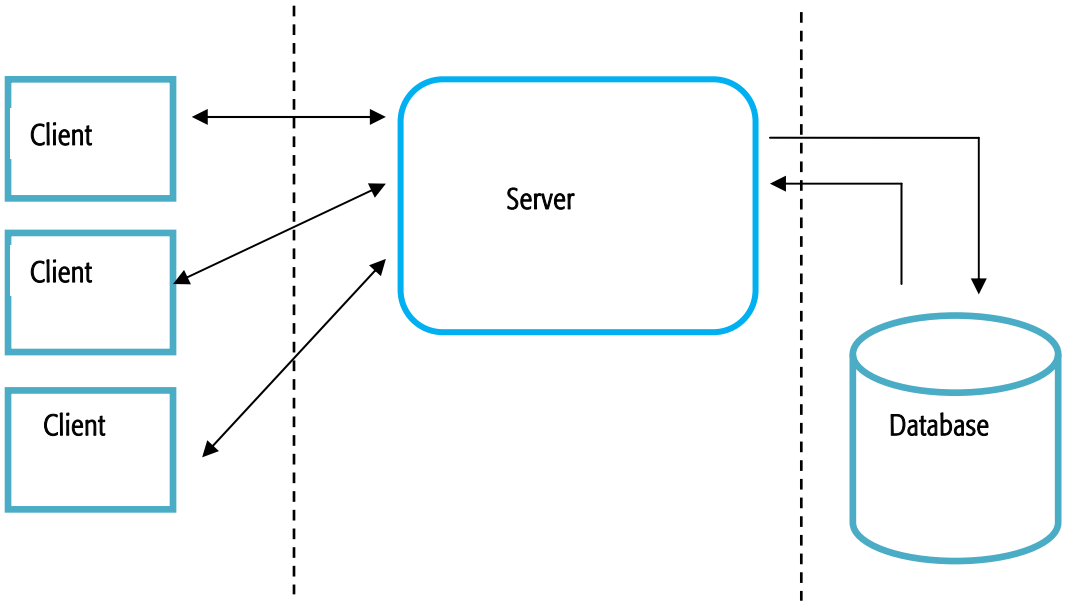
SDK – Software development kit

1. Introduction

The purpose of this document is to provide complete documents to the end users and thus allow them to be able to work independently during the customisation of PlantVisorPRO.
PlantVisorPRO is an application based on 3-level framework.

These 3 levels are divided into:
- the Data component, which resides in the Database;
- the Business component, which resides on the Server;
- the Presentation component, which resides on the PC that accesses the application.



1.1 Database

The database, which contains all the configuration, historical and log data, is implemented using the PostegreSQL 8.1 system.
Standard SQL language is used to retrieve the information.

1.2 Server

The server, where all the business logic is implemented, is fully developed in JAVA and runs on Apache Tomcat 5.0. The server is the bridge between the graphic representation of the data (client) and the data itself (database). To make the exchange of the data with the client more secure, HTTPS communication is used to create an encrypted channel with authentication by certificate.

1.3 Client

The client is the application that allows the end user to log in, configure and manage the site. Currently the PlantVisorPRO graphic interface is compatible with Internet Explorer version >= 6.1.

2. Approach

SDK for PlantVisorPRO has been conceived following the same philosophy by which Enhanced users created the custom pages on the Supervisor.
The Enhanced scripting language has been replaced by the JAVA programming language, and the pages on the graphic display are not simple HTML templates but rather JSP documents (Java Server Pages).

The two main advantages of this new technology are:

1. For the creation of new pages, as the JAVA language is very widely used by developers, it is much easier to find people who know it and know how to use most of its functions;

2. The introduction of JSP brings greater flexibility and development potential.

The syntax of the statements is similar to the CAREL proprietary script. All the statements must start and end with the following characters:

```
<% ..... %>
```

The following is a simple example of the declaration of an integer variable:

```
<% int i = 0; %>
```

For complete details on the language and the creation of JSP files, the official SUN documents are available at the following address:

http://java.sun.com/j2ee/tutorial/1_3-fcs/doc/JSPIntro.html

3. Installation

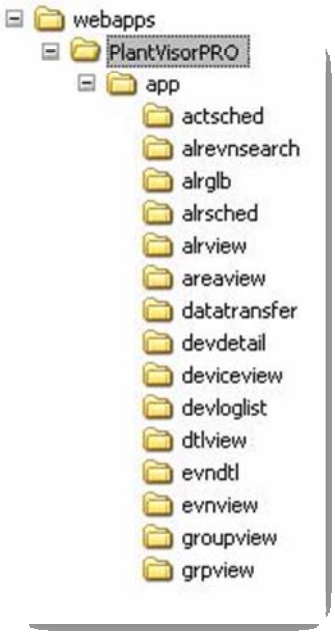
All the various html files describing the Enhanced version are contained in the following directory:

C:\PlantVisor\ServerComponents\html.

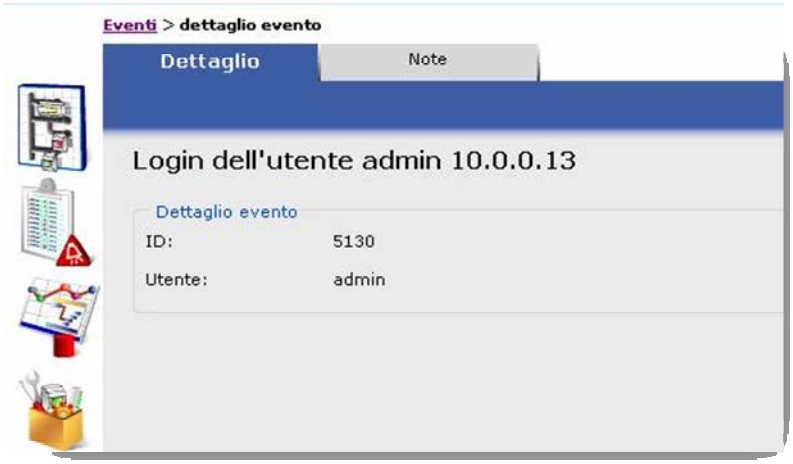
Similarly, the PlantVisorPRO project files are all contained in the following directory:

C:\Carel\PlantVisorPRO\engine\webapps\PlantVisorPRO\.

The "APP" subdirectory then contains a directory containing all the groups of functions developed in the standard version.



Each directory contains JSP files that represent the TABS on the Supervisor interface and the corresponding functions.



If a user wants to totally rewrite a certain function, the framework of the PlantVisorPRO has been designed to check a specific physical path in the PC filesystem to see whether that function has a page rewritten by the user or the standard is sued. The following is a practical example of this.

Assuming that a user needs to customise, as in most cases, the device detail page for the IO MODULE instrument. In the standard version, this function is implemented by the following JSP resource :

C:\Carel\PlantVisorPRO\engine\webapps\PlantVisorPRO\app\dtlview\ SubTab1.jsp

The framework, before starting a transaction, checks the filesystem to see whether there is a custom version for the resource it is about to load. In the example, this must be located in:

C:\Carel\PlantVisorPRO\engine\webapps\PlantVisorPRO\custom\dtlview\ io_module\ SubTab1.jsp.

If the SubTab1.jsp file exists, the Supervisor loads the file found rather than the version in the standard path. In this way, the user can overwrite any function, without the risk of deleting the basic functions and without having to worry about making backup copies.

The new JSP files created by the user must be implemented by:

- Standard scripting language for JSP ;
- API (Application Programming Interface) provided in the PlantVisorPRO SDK.

These APIs feature functions to user independent and flexible when programming the pages.
References to objects and attributes have been based on the Enhanced version, so as to ensure a certain familiarity when porting the applications.

4. API

4.1 CurrVar

The CURRVAR object represents the variable that is currently selected by its CODE.

METHODS

int getId();
Returns the unique identifier used by the database for the current variable.

String getValue();
Returns the value from the field for that specific variable.

String getRefreshableValue();
Returns the value from the field for that specific variable and makes it refreshable.

String getDescription();
Returns the description corresponding to the current variable.

String getMUnit();
Returns the unit of measure corresponding to the current variable.

String getDescr1();
Returns the short description corresponding to the current variable.

String getDescr2();
Returns the long description corresponding to the current variable.

int getType();
Returns the type of the current variable:

- 1 -> Digital;
- 2 -> Analogue;
- 3 -> Integer;
- 4 -> Alarm;

boolean getBAnd(int mask);
Performs an AND between the value of the variable and a screen represented by the MASK parameter. Returns TRUE if the value that is the object of the AND is equal to screen. Otherwise FALSE.

String getCode();
Returns the unique name of the variable.

String getSetField();
Returns the HTML string that represents the text field to be entered on the page, together with the suitable references for sending the server the correct parameter setting information.

String postName();
Returns the program code to be used for the 'id' and 'name' attributes of the text field used for setting the parameter, if the text fields used on the page need to be customised.

String getRefreshableAssint(String decod);
Starting from the decod parameter, a string made up of values separated by ';', returns the value of the string with the index corresponding to the current value of the variable.

String getRefreshableAssint(String decod, String off);
Starting from the decod parameter, a string made up of values separated by ';', returns the value of the string with the index corresponding to the current value of the variable. If there is no correspondence, the value 'off' is returned.

4.2 CurrAlarm

The CURRALARM object represents the active alarm on the current device.

METHODS

int getIdalr();
Returns the unique ID in the database relating to the active alarm.

String getDesc();
Returns the description corresponding to the active alarm.

String getDate();
Returns the date and time the alarm was activated.

String getAckuser();
Returns the username of the user who acknowledged the alarm (ack), otherwise returns an empty string

String getAcktime();
Returns the date the alarm was acknowledged (ack), otherwise returns an empty string.

String getResetuser();
Returns the username of the user who reset the alarm, otherwise returns an empty string.

String getResettime();
Returns the date the alarm was reset, otherwise returns an empty string.

String getPriority();
Returns the priority of the alarm. The following values are possible:

- Highest
- High
- Medium
- Low

4.3 CurrUnit

The CURRUNIT object represents the current device. On the device detail page, it is the framework that points to the unit selected by the user.

METHODS

int getId();
Returns the unique ID in the database relating to the current unit.

String getDescription();
Returns the description of the device.

String getLine();
Returns the line the device belongs to.

int getStatus();
Returns an integer representing the status of the device:

- 0 -> OFFLINE (gray)
- 1 -> ONLINE (green)
- 2 -> ALARM (red)
- 3 -> DISABLED (blue)

String getImage();
Returns the path relating to the default image assigned to the device.

CurrVar getVariable(String vCode);
Returns a reference to the CurrVar object. This object represents the variable requested by the user with the input parameter: "vCode".

boolean loadAlarms();
Loads the alarms corresponding to the device. If at least one alarm is active, returns TRUE, otherwise FALSE.

int getAlarmNumber();
Returns the number of active alarms on the device, including those that have been:

- ACK;
- RESET;

by the user.

CurrAlarm getAlarmAt(int idx);
Returns the reference to the alarm, with the input index "idx".

String getRefreshableStatusAssint(String decod);
Starting from the decod parameter, a string made up of values separated by ';', returns the value of the decod string according to the following indices, corresponding to different states:

- 0: offline
- 1: online ok
- 2: online with alarm
- 3: disabled

String getRefreshableStatusAssint(String decod, String off);
Starting from the decod parameter, a string made up of values separated by ';', returns the value of the decod string according to the following indices, corresponding to different states:

- 0: offline
- 1: online ok
- 2: online with alarm
- 3: disabled

If the status cannot be recovered, the string 'off' is returned.

4.4 CurrNode

The CURRNODE object represents the current site with all its devices configured.

METHODS

int getLenght();
Returns the total number of devices configured on the site.

CurrUnit getCurrUnitAt(int idx);
Returns the reference to the unit, with the input index "idx".

4.5 CurrUser

The CURRUSER object represents the connected user. This object includes the rights that the user has for writing certain parameters. These parameters are divided into:

- Manufacturer parameters;
- Service parameters;

METHODS

boolean haveServicesRight();
Returns TRUE if the user has the right to write the parameters marked as SERVICE, otherwise FALSE.

boolean haveManufacturerRight();
Returns TRUE if the user has the right to write the parameters marked as MANUFACTURER, otherwise FALSE.

boolean HaveRight(int r);
The input integer is as follows:

- 1 -> Rights on the service parameters;
- 2 -> Rights on the manufacturer parameters;

Returns TRUE, for example, when the input is 1 and the user has rights on the service parameters.

4.6 Sfera

The Sfera object makes the following functions available to the developer:

String assint(float value, String decod, String off);

The ASSINT function reflects the same function offered by the Enhanced scripting language.
The first parameter in the function represents the value of the variable (integer or digital).
The second parameter represents the string to be displayed based on the value of the first parameter.
The third parameter represents the string to be displayed to the user if offline.

Example:

Sfera.assint(CurrUnit.getVariable("DI1").getValue(), "<img src='images/led/L0.gif'>;<img src='images/led/L1.gif'>", "***");

Based on the value of the variable DI1, the function returns the first image if equal to 0, the second image if equal to 1. If, on the other hand, the value of the variable is not available because the device is OFFLINE, the function returns the third parameter ("***").

String format(float value,String pattern);

Returns the input value of the first parameter formatted based on the input pattern of the second parameter.

String assint(String value, String decod, String off);

The function performs the same operation and provides the same results as the previous one, however the input variable is a string, rather than a float value. The value is previously converted to check that it is numeric and then processed.

String format(String value, String pattern);

In this case too, the function is identical to the previous one, however receives a string input rather than a numeric value.

5. JAVASCRIPT

The PlantVisorPRO pages, once processed and executed, are converted from JSP files to HTML documents.
The Javascript language is fundamental for the management of the events on the client.
The framework provides the user functions that have already been implemented so as to simplify navigation on the page.

Currently the following functions are implemented:

PVPK_goToDetail(idDevice);

The user can access the device detail page identified by the input parameter: idDevice.

PVPK_goToMoreVars(sDescription);

The user can access the page with the complete list of all the read-only variables of the device. This can only be used on the device detail page, as elsewhere it would not have any sense. The sDescription parameter represents the string that the user wants to display in the top navigation menu.

PVPK_ActiveRefresh(iTimeSecond);

The user refreshes the variables, based on the input period in seconds.

PVPK_addButtons();

The user displays the buttons for refreshing and setting the parameters.

PVPK_setData(obj)

The user can use this function to send a request to the server for setting parameters. The obj parameter contains the reference to the object that has originated the request (which must be in a form). Using the object, the framework retrieves the form containing the data and sends the correct request to the server.

As well as these functions, to the user is provided with a file, in the following path:

C:\Carel\PlantVisorPRO\engine\webapps\PlantVisorPRO\scripts\custom\custom.js

Users can enter their management functions inside this file.
As well as any new functions, a number of callback functions have been implemented.

PVP_OnLoad

```
/*
 * This function allows the user
 * to have a callback once the page has been loaded.
 * Parameters:
 * - sFolder: Directory of the map;
 * - sResource: Name of the JSP file called;
 * - sDevice: Name of the device directory;
 *     [Present only if device in detail]
 */
function PVP_OnLoad(sFolder,sResource,sDevice)
```

PVP_goToDetail

The function incorporates the framework function presented previously that allows the user to further customise the behaviour and the operations carried out by the function

```
/*
 * This function allows the user
 * to access to the device detail page.
 * Parameters:
 * - idDevice: Id of the device. Retrieved by CurrUnit.getId();
 */
function PVP_goToDetail(idDevice)
{
      PVPK_goToDetail(idDevice);
}
```

PVP_goToVariables

The function incorporates the framework function presented previously that allows the user to further customise the behaviour and the operations carried out by the function

```
/*
 * This function allows the user
 * read-only access to the variables page.
 * Parameters:
 * - sDescription: Description provided to the user in the NAVMENU
 */
function PVP_goToVariables(sDescription)
{
      if(!sDescription)
            sDescription = "";
      PVPK_goToMoreVars(sDescription);
}
```

PVP_OnLoad

The function incorporates the framework function presented previously that allows the user to further customise the behaviour and the operations carried out by the function. It can be seen how the standard version of the function has already configured the variables to be refreshed every 2 seconds and has activated the display of the buttons for refreshing and setting the parameters.

```
/*
 * This function allows the user
 * to  have a callback once the page has been filled.
 * Parameters:
 * - sFolder: Directory of the map;
 * - sResource: Name of the JSP file called;
 * - sDevice: Name of the device directory;
 *     [Present only if device in detail]
 */
function PVP_OnLoad(sFolder,sResource,sDevice)
{
      PVPK_ActiveRefresh(2);
      PVPK_addButtons();
}
```

PVP_setData

The function incorporates the framework function presented previously that allows the user to further customise the behaviour and the operations carried out by the function, for example with prior checks on the data entered before being sent to the server..

```
/*
 * This function allows the user
 * to perform operations on the values of the parameters to be modified
 * before and after being sent to the server, entering javascript code
 * before and/or after the call to the framework function.
 * Parameters:
 * - obj: object that triggered the call, typically
 *    a confirm button on the page
 */
function PVP_setData(obj)
{
      PVPK_setData(obj);
}
```

6. CSS

If the user wishes to customise the pages using cascading style sheets outside of the JSP code, the framework provides 2 files.

- customIE.css;
- customFF.css

These two files are loaded independently, also based on the type of browser being used.
The first for Internet Explorer, the second for Firefox.

7. XSL STYLE SHEETS FOR ALARMS

To allow the user to customise the alarms, while at the same time maintaining all the refresh functions, the concept of style sheet has been introduced.
These files contain the logic for formatting the data contained in the XML packets sent by the server and at the same time are extremely easy to customise.

The XSL style sheet must be located in the same directory as the custom page, and named as follows:

stylesheet.xsl.

The skeleton of the sheet is as shown below, and already contains a sufficiently explicative example, with various options:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

<xsl:template match="/">

<table width="100%" align="center" border="1">
   <thead style="font-size: x-small">
   <tr>
   <th width="12%">Data ora</th>
   <th width="*">Descrizione</th>
   <th width="5%">Priorità</th>
   <th width="10%">Ack user</th>
   <th width="12%">Ack time</th>
   <th width="10%">Reset user</th>
   <th width="12%">Reset time</th>
   </tr>
   </thead>

   <tbody style="font-size: xx-small;background:red;">
      <xsl:for-each select="response/alarms/alr">
         <tr>
            <td>
               <xsl:choose>
                  <xsl:when test="datetime != ''">
                     <xsl:value-of select="datetime"/>
                  </xsl:when>
                  <xsl:otherwise>
                     <div align="center">---</div>
                  </xsl:otherwise>
               </xsl:choose>
            </td>
            <td>
               <xsl:choose>
                  <xsl:when test="description != ''">
                     <xsl:value-of select="description"/>
                  </xsl:when>
                  <xsl:otherwise>
                     <div align="center">---</div>
                  </xsl:otherwise>
               </xsl:choose>
            </td>
            <td>
               <xsl:choose>
                  <xsl:when test="priority != ''">
                     <xsl:value-of select="priority"/>
                  </xsl:when>
                  <xsl:otherwise>
                     <div align="center">---</div>
                  </xsl:otherwise>
               </xsl:choose>
            </td>
            <td>
               <xsl:choose>
                  <xsl:when test="ackuser != ''">
                     <xsl:value-of select="ackuser"/>
                  </xsl:when>
                  <xsl:otherwise>
                     <div align="center">---</div>
                  </xsl:otherwise>
               </xsl:choose>
            </td>
            <td>
               <xsl:choose>
                  <xsl:when test="acktime != ''">
                     <xsl:value-of select="acktime"/>
```

```
                    </xsl:when>
                    <xsl:otherwise>
                        <div align="center">---</div>
                    </xsl:otherwise>
                </xsl:choose>
            </td>
            <td>
                <xsl:choose>
                    <xsl:when test="resetuser != ''">
                        <xsl:value-of select="resetuser"/>
                    </xsl:when>
                    <xsl:otherwise>
                        <div align="center">---</div>
                    </xsl:otherwise>
                </xsl:choose>
            </td>
            <td>
                <xsl:choose>
                    <xsl:when test="resettime != ''">
                        <xsl:value-of select="resettime"/>
                    </xsl:when>
                    <xsl:otherwise>
                        <div align="center">---</div>
                    </xsl:otherwise>
                </xsl:choose>
            </td>
        </tr>
    </xsl:for-each>
  </tbody>
</table>
</xsl:template>
</xsl:stylesheet>
```

The customisable HTML TAGS can be easily recognised, with the most suitable style and format.
The page is in fact completely formatted by the static HTML part and does not interface in any way with the management of the XML part.

The XSL tags, using the cycle construction:
<xsl:for-each …>

allow all the alarm data to be read from the XML packet and then entered into the cells of the table.

To improve the result, a conditional choice construction has also been used
<xsl:choose …>
which guarantees that the cells are filled with data even if some of the values are missing.

8. COMPLETE EXAMPLE

A complete example can better help the developer to understand the basic steps required to customise the pages.
Assuming the developer wants to customise the detail for the following device:

Module IO.

First of all, the following file needs to be created:

SubTab1.jsp

The first lines of code in the file must be as follows, to allow it to be integrated into the framework:

```
<%@ page language="java"
        import="com.carel.supervisor.presentation.sdk.util.Sfera"
        import="com.carel.supervisor.presentation.helper.ServletHelper"
%>
<jsp:useBean id="CurrUnit" class="com.carel.supervisor.presentation.sdk.obj.CurrUnit" scope="session"/>
<%
  CurrUnit.setCurrentSession(ServletHelper.retrieveSession(request.getRequestedSessionId(),request));
%>
```

Using these statements, the JSP page can access the objects made available by the framework; in particular, the reference to the current unit, i.e. the device is loaded into the memory, as well as the Sfera object for accessing the functions.

Then a table is created in HTML that contains the following information:

- The status of the device;
- The name of the device;
- The serial line it is connected to.

```
<table border="0" width="100%" height="100%" cellpadding="1" cellspacing="1">
  <tr>
    <td valign="top" width="5%" align="center">
      <%=Sfera.assint(CurrUnit.getStatus(),"<img src='images/led/L0.gif'>;
      <img  src='images/led/L1.gif'>", "<img  src='images/led/default.gif'>")%>
    </td>
    <td valign="top" width="*" align="left">
      <font size="4"><b><%=CurrUnit.getDescription()%></b></font>
    </td>
    <td valign="top" width="20%" align="right"><b><%=CurrUnit.getLine()%></b></td>
  </tr>
</table>
```

The first line highlighted in yellow uses the CurrUnit object to request the status. The range of values is between 0 and 3.

- 0 -> OFFLINE (gray)
- 1 -> ONLINE (green)
- 2 -> ALARM (red)
- 3 -> DISABLED (blue)

This value is the used as the input for the assint function.
In this way, if the status value is equal to 0, the function returns the following string:

<img src='images/led/L0.gif'>.

If the status value is equal to 1, the function returns the following string:

<img src='images/led/L1.gif'>

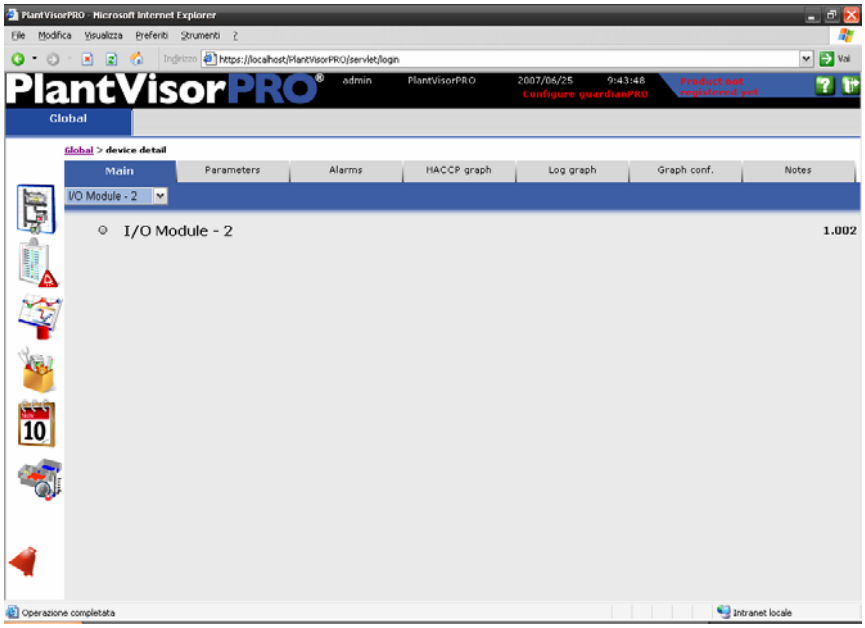
If the status value does not corresponds to one of these two values, then the function returns the default string:

<img src='images/led/default.gif'>.

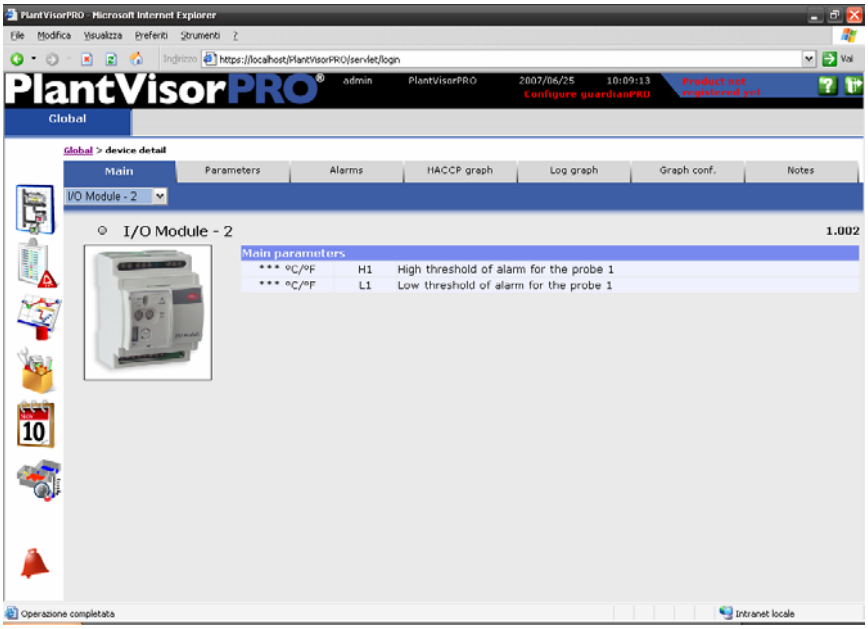
The second line, highlighted in green, is used to retrieve the description of the device.

The third line, highlighted in blue, returns the references for the line that the device is connected to.

The resulting page will be as follows:



The above page can then be added with the default image of the device and a table with the three high and low probe temperature thresholds. The end result is as follows:



The code for programming the page illustrated above is as shown below.
The lines of code of special interest have been highlighted for easier identification and are then described afterwards.

```
<%@ page language="java"
        import="com.carel.supervisor.presentation.sdk.util.Sfera"
        import="com.carel.supervisor.presentation.helper.ServletHelper"
%>
<jsp:useBean id="CurrUnit" class="com.carel.supervisor.presentation.sdk.obj.CurrUnit" scope="session"/>
<%
CurrUnit.setCurrentSession(ServletHelper.retrieveSession(request.getRequestedSessionId(),request));
%>

<table border="0" width="100%" height="100%" cellpadding="1" cellspacing="1">
  <tr height="5%">
    <td valign="top">
      <table border="0" width="100%" height="100%" cellpadding="1" cellspacing="1">
          <tr>
            <td valign="top" width="5%" align="center">
             <%=Sfera.assint(CurrUnit.getStatus(),"<img src='images/led/L0.gif';><img
src='images/led/L1.gif'>")%>
           </td>
          <td valign="top" width="*" align="left">
             <font size="4"><b><%=CurrUnit.getDescription()%></b></font>
          </td>
          <td valign="top" width="20%" align="right"><b><%=CurrUnit.getLine()%></b>
           </td>
        </tr>
      </table>
    </td>
  </tr>
  <tr height="*">
    <td valign="top">
      <table border="0" width="100%" height="100%" cellpadding="1" cellspacing="1">
        <tr height="*">
          <td width="20%" valign="top"><img src="<%=CurrUnit.getImage()%>" border="1"
style="width:150px;height:160px;"></td>
          <td width="*" valign="top">
            <table border="0" width="100%" cellpadding="1" cellspacing="1">
              <tr>
                <td colspan="3" style="background-color:#7788EE;"><font color="white"><b>Main
parameters</b></font></td>
              </tr>
              <tr>
                 <td width="15%" align="center" style="background-color:#eff1fe;">
        <%=CurrUnit.getVariable("H1").getValue()%> <%=CurrUnit.getVariable("H1").getMUnit()%>
                 </td>
                 <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("H1").getDescr1()%></td>
                 <td width="*" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("H1").getDescription()%></td>
              </tr>
              <tr>
                 <td width="15%" align="center" style="background-color:#eff1fe;">
       <%=CurrUnit.getVariable("L1").getValue()%> <%=CurrUnit.getVariable("L1").getMUnit()%>
                 </td>
                 <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("L1").getDescr1()%></td>
                 <td width="*" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("L1").getDescription()%></td>
              </tr>
            </table>
          </td>
        </tr>
      </table>
    </td>
  </tr>
</table>
```

The first line, highlighted in yellow, allows the user to retrieve the complete path of the default image corresponding to the specific model of device.

The second line, highlighted in green, groups together two statements: The retrieval of the value of variable H1 and its corresponding unit of measure.
If the unit is offline and the values are not available, the framework returns 3 asterisks (“***”).

The third line, highlighted in blue, displays the short description of the variable.

The fourth line, highlighted in purple, displays the description of the variable.

We will now look at the device details, the table with the list of active alarms.

To be able to load the list of alarms for the current device, a line of code needs to be entered at the start of the JSP file:

```
<%@ page language="java"
        import="com.carel.supervisor.presentation.sdk.util.Sfera"
        import="com.carel.supervisor.presentation.helper.ServletHelper"
%>
<jsp:useBean id="CurrUnit" class="com.carel.supervisor.presentation.sdk.obj.CurrUnit" scope="session"/>
<%
  CurrUnit.setCurrentSession(ServletHelper.retrieveSession(request.getRequestedSessionId(),request));
  CurrUnit.loadAlarms();
%>
```

This requests the CurrUnit object to load the list of active alarms for the device into the memory.

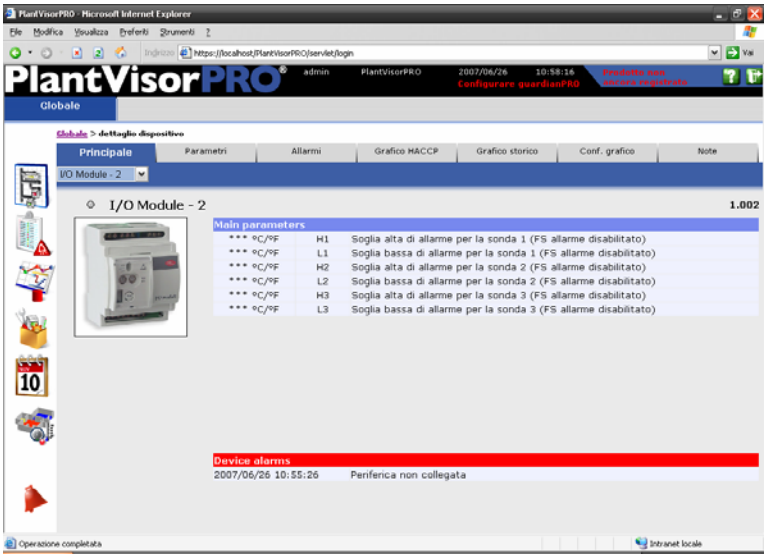
To display these in a table, the following code is used:

```
<table border="0" width="100%" cellpadding="1" cellspacing="1">
 <tr>
  <td colspan="2" style="background-color:#FF0000;"><font color="white"><b>Device alarms</b></font></td>
 </tr>
 <%for(int i=0; i<CurrUnit.getAlarmNumber(); i++) {%>
 <tr>
  <td width="25%" style="background-color:#eff1fe;"><%=CurrUnit.getAlarmAt(i).getDate()%></td>
  <td width="*" style="background-color:#eff1fe;"><%=CurrUnit.getAlarmAt(i).getDesc()%></td>
 </tr>
 <%}%>
</table>
```

Once the active alarms have been loaded into the memory, a FOR cycle can be used to loop the following procedure.
For each alarm currently pointed to, the information can be retrieved. In the example described above, the following are retrieved:

- Date of the alarm;
- Description of the alarm.

The block of code, integrated with the rest of the example, creates a page shown in the following example:



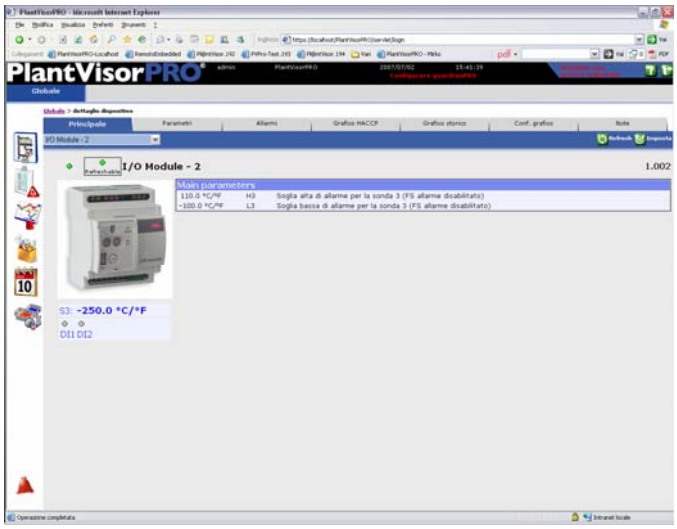
The functions presented until now have a corresponding version with refresh, associated with the function of the framework that manages the automatic update of the page without reloading it in the browser.
In order to use the following function, the data refresh ability must be activated with **PVPK_ActiveRefresh()**.
Continuing then with the creation of the page, the variables already entered in static mode will be joined by the corresponding refreshable versions, so as to highlight the differences and in particular the effective refreshing of the values.
The activation of the refresh function is added to the **custom.js** file, already described previously:

```
function PVP_OnLoad(sFolder,sResource,sDevice)
{
        PVPK_ActiveRefresh(2);
}
```

Highlighted in yellow is the statement that activated the refresh every 2 seconds (that is, the minimum time to ensure the server is not overloaded with refresh requests).
The first step is to add the status LED with refresh to the page:

```
<table border="0" width="100%" height="100%" cellpadding="1" cellspacing="1">
    <tr>
        <td valign="middle" width="5%" align="center">
        <%=Sfera.assint(CurrUnit.getStatus(),
                "<img src='images/led/L0.gif'>;<img src='images/led/L1.gif'>;<img
src='images/led/L2.gif'>;<img src='images/led/L3.gif'>")
        %>
        </td>
        <td valign="middle" width="5%" align="center" style="border:1px solid black;">
        <%=CurrUnit.getRefreshableStatusAssint("<img src='images/led/L0.gif'>;<img
src='images/led/L1.gif'>;<img src='images/led/L2.gif'>;<img src='images/led/L3.gif'>")
        %>
        <br/>
        <span style="font-size: xx-small;">Refreshable</span>
        </td>
        <td valign="middle" width="*" align="left">
        <font size="4"><b><%=CurrUnit.getDescription()%></b></font>
        </td>
        <td valign="middle" width="5%" align="right">
        <b><%=CurrUnit.getLine()%></b>
        </td>
    </tr>
</table>
```

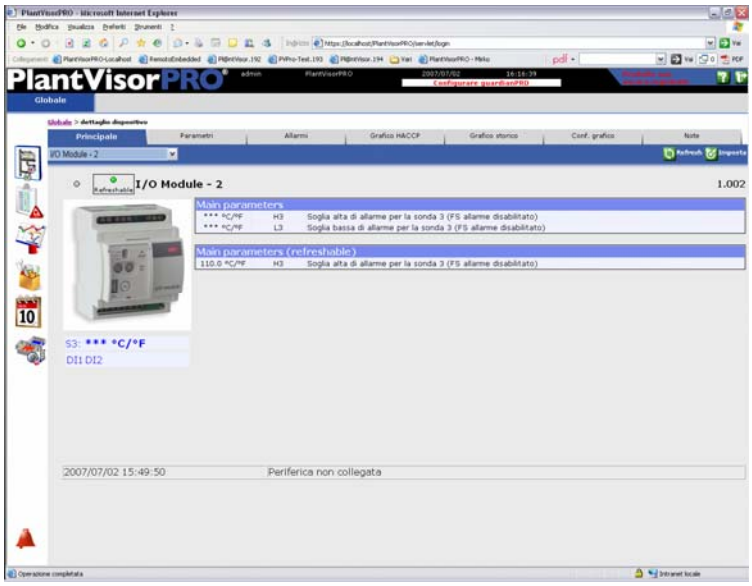
As described previously with this call, the device status LED is added, mapping the different colours of the object with the values returned for the status. The result, which is refreshed by the framework, is as follows:



Now the "refreshable" status has been added to the standard non-refreshable status and provides an instant picture (save for the refresh time) of the status of the device. Obviously, the 2 states are completely independent, and therefore on a real custom page only one of the 2 will be used, according to requirements.
In addition, on the top right is the refresh button, used to manually refresh the page. The display of the button is activated by the special *PVPK_addButtons()* function.
Similarly, the variables can be added with refresh, and are always updated automatically by the framework. An example of adding variables with refresh is shown below:

```
<table border="0" width="100%" cellpadding="1" cellspacing="1"  style="border: 1px solid black;">
    <tr>
        <td colspan="3" style="background-color:#7788EE;">
        <font color="white"><b>Main parameters (refreshable)</b></font>
        </td>
    </tr>
    <tr>
        <td width="10%" align="center" style="background-color:#eff1fe;font-size: x-small;">
        <NOBR><%=CurrUnit.getVariable("H3").getRefreshableValue()%>
<%=CurrUnit.getVariable("S3").getMUnit()%></NOBR>
        </td>
        <td width="10%" align="center" style="background-color:#eff1fe;font-size: x-
small;"><%=CurrUnit.getVariable("H3").getDescr1()%></td>
        <td width="*" style="background-color:#eff1fe;font-size: x-
small;"><%=CurrUnit.getVariable("H3").getDescription()%></td>
    </tr>
</table>
```

In this example, the point of greatest significance is the statement highlighted in yellow: this statement requests the value of the variable from the SDK framework and in the meantime records the variable for refreshing. The result can be seen in the following figure, where the device that returns online has been detected in the areas recorded as refreshable.



SDK also includes other types of buttons.
For the correct operation of these, the command to import the UserSession object needs to be added to the page header, therefore we will create an object called "sessionUser"

```
<%@ page import="com.carel.supervisor.presentation.session.UserSession" %>
<% UserSession sessionUser=ServletHelper.retrieveSession(request.getRequestedSessionId(),request); %>
```

Following this, we will add a button anywhere on the page for setting a parameter.

```
public String getSimpleButton(int pageId, String value, String srcImage, String shortDesc)

Esempio:
<%=CurrUnit.getVariable("OK_RST_AL").getSimpleButton(100,"1","images/button/reset.png","Alarm reset")%>
```

The function uses the following parameters:

- **pageId**: number that uniquely identifies the button on the page.
- **value**: value to be set for the variable.
- **srcimage**: string containing the path of the image that represents the button.
- **shortDescr**: tooltip that is shown when running the mouse over the button.

The next lines of code, on the other hand, are used to build a button for synchronising the clock on the device with the current time. In the page header, together with "sessionUser" (described above), we will create the "syncronow" object.

```
<% String syncronow = sessionUser.getPropertyAndRemove("syncronow"); %>
<input type='hidden' id='dosyncro' value="<%=syncronow%>" />
```

A button can be added anywhere on the page for setting a parameter.

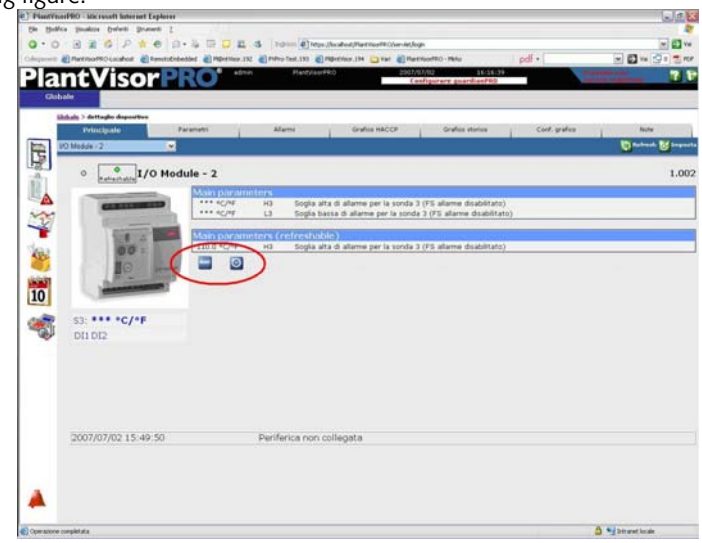
```
public String getSyncTimeButton(int id_hh,int id_mm,int id_ack)

Esempio:
<%=CurrUnit.getSyncTimeButton(CurrUnit.getVariable("LHOUR").getId(), CurrUnit.getVariable("LMINUTE").getId(),
CurrUnit.getVariable("SET_CLOCK").getId())%>
```

The function uses the following parameters:

- **id_hh**: id of the "hours" variable.
- **id_mm**: id of the "minutes" variable.
- **id_ack**: id of the "confirm time" variable.

The use of the synchronisation function is now strictly linked to devices where the time is set by sending the confirmation parameter.

The result is shown in the following figure:



Continuing the illustration of the SDK function, the example below shows how to include refreshable variables on the page associated with images:

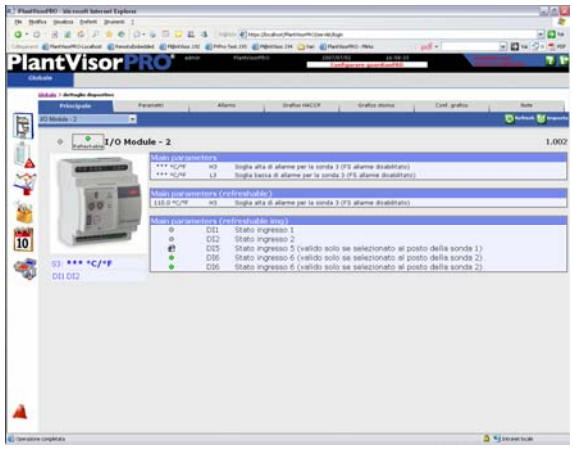
```
<table border="0" width="100%" cellpadding="1" cellspacing="1"  style="border: 1px solid black;">
  <tr>
    <td colspan="3" style="background-color:#7788EE;"><font color="white"><b>Main parameters (refreshable
img)</b></font></td>
  </tr>
  <tr>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI1").getRefreshableAssint("<img src='images/led/L0.gif';<img
src='images/led/L1.gif'>")%> </td>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI1").getDescr1()%></td>
    <td width="*" style="background-color:#eff1fe;"><%=CurrUnit.getVariable("DI1").getDescription()%></td>
  </tr>
  <tr>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI2").getRefreshableAssint("<img src='images/led/L0.gif';<img
src='images/led/L1.gif'>")%> </td>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI2").getDescr1()%></td>
    <td width="*" style="background-color:#eff1fe;"><%=CurrUnit.getVariable("DI2").getDescription()%></td>
  </tr>
  <tr>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI5").getRefreshableAssint("<img src='images/led/PVE.gif';<img
src='images/led/PVP.gif'>")%> </td>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI5").getDescr1()%></td>
    <td width="*" style="background-color:#eff1fe;"><%=CurrUnit.getVariable("DI5").getDescription()%></td>
  </tr>
  <tr>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI6").getRefreshableAssint("<img src='images/led/L0.gif';<img
src='images/led/L1.gif'>")%> </td>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI6").getDescr1()%></td>
    <td width="*" style="background-color:#eff1fe;"><%=CurrUnit.getVariable("DI6").getDescription()%></td>
  </tr>
  <tr>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI6").getRefreshableAssint("<img src='images/led/L0.gif';<img
src='images/led/L1.gif'>")%> </td>
    <td width="10%" align="center" style="background-
color:#eff1fe;"><%=CurrUnit.getVariable("DI6").getDescr1()%></td>
    <td width="*" style="background-color:#eff1fe;"><%=CurrUnit.getVariable("DI6").getDescription()%></td>
  </tr>
</table>
```

Based on the values available for the variable in question (only digital or integer), the corresponding value is obtained, which in the most typical case is an image encapsulated in the corresponding HTML tag.

The example highlights different situations:

- Yellow: classic example of using a LED to represent the on-off status of a digital variable
- Green: example of using images as desired to represent the different states. For integer variables, a different image can be used for each possible value of the variable.
- Blue: the values can be duplicated: different displays can be used in different areas and if necessary with different presentations for the same variable, all transparently to the framework.

The result on the custom page is shown in the following figure:

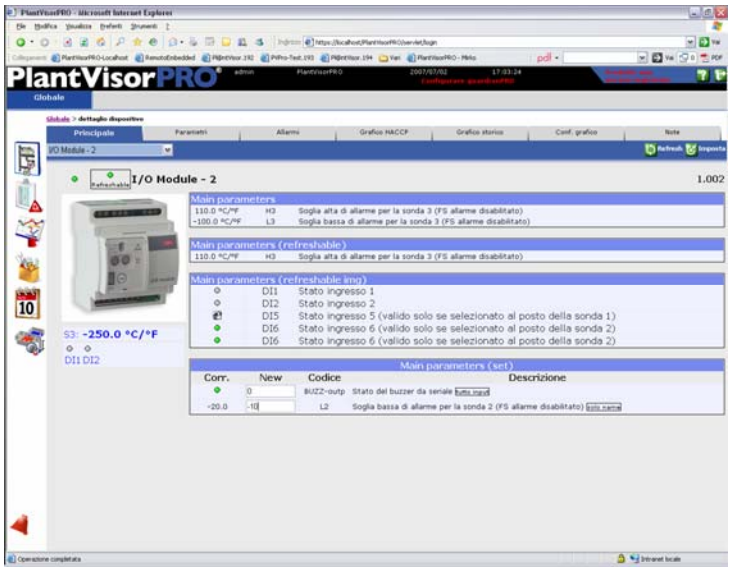


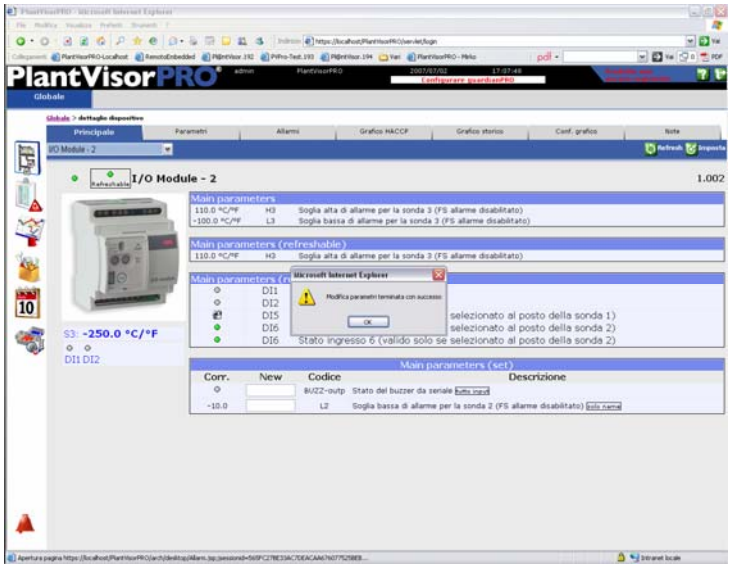
Further options are provided by the possibility to set the parameters in the fields in 2 different ways:

- Complete field: the framework generates all the code required to achieve a text field related to the parameter in question, for setting the value
- Name only: with this option, the user can customise the text field as desired, modifying the layout and/or adding checks on the data entered. The SDK function will set the correct ID and name of the text field to link it to the variable.

```
<form id="formSettableVars" name="formSettableVars">
<table border="0" width="100%" cellpadding="1" cellspacing="1" style="border: 1px solid black;"
<tr>
    <td width="10%" align="center" style="background-color:#eff1fe;font:x-small;">
    <%=CurrUnit.getVariable("BUZZ_OUTPUT").getRefreshableAssint("<img src='images/led/L0.gif'>;<img
src='images/led/L1.gif'>","***")%>
    </td>
    <td width="10%" align="center" style="background-color:#eff1fe;font:x-small;">
    <%=CurrUnit.getVariable("BUZZ_OUTPUT").getSetField()%>
    </td>
    <td width="10%" align="center" style="background-color:#eff1fe;font:x-small;">
    <%=CurrUnit.getVariable("BUZZ_OUTPUT").getDescr1()%>
    </td>
    <td width="*" style="background-color:#eff1fe;font:x-small;">
    <%=CurrUnit.getVariable("BUZZ_OUTPUT").getDescription()%>
    <SPAN style="border:1px solid black;font-size:xx-small;">tutto input</SPAN>
    </td>
</tr>
<tr>
    <td width="10%" align="center" style="background-color:#eff1fe;font:x-small;">
    <%=CurrUnit.getVariable("L2").getRefreshableValue()%>
    </td>
    <td width="10%" align="center" style="background-color:#eff1fe;font:x-small;">
    <input type="text" name="<%=CurrUnit.getVariable("L2").getPostName()%>"
id="<%=CurrUnit.getVariable("L2").getPostName()%>" style="width:95%;" value="">
    </td>
    <td width="10%" align="center" style="background-color:#eff1fe;font:x-small;">
    <%=CurrUnit.getVariable("L2").getDescr1()%>
    </td>
    <td width="*" style="background-color:#eff1fe;font:x-small;">
    <%=CurrUnit.getVariable("L2").getDescription()%>
    <SPAN style="border:1px solid black;font-size:xx-small;">solo name</SPAN>
    </td>
</tr></table></form>
```

The 2 different methods presented are highlighted in the example; the statement used to create the default "**all-in-one**" text field is highlighted in yellow.
The lines highlighted in blue show how to use the more customisable version of the statement: the user independently creates the **input text** field, with the only link being setting the **name** and the **id** to the value returned by the **getPostName()** SDK function.
The result of the setting operation can be seen in the sequence of images shown below:

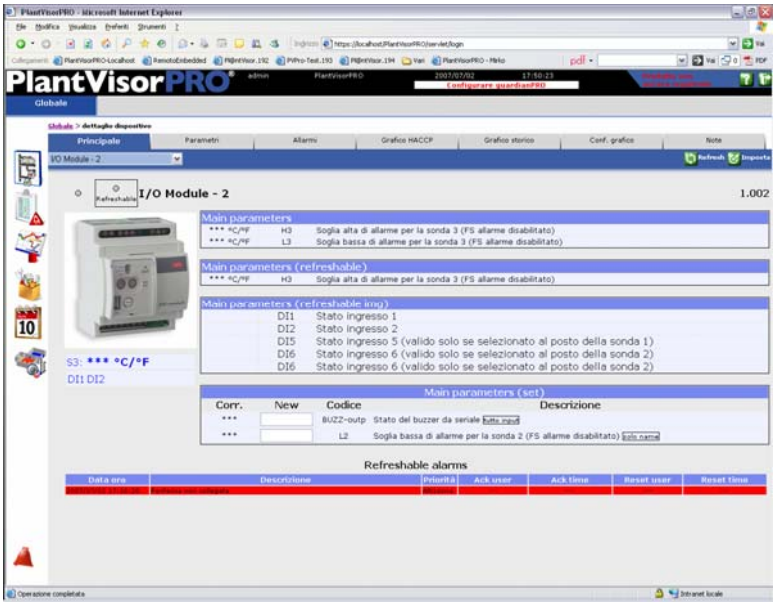




Also note the button at the top right that is used to set the values in the field after having completed the *textfields* on the page, as an alternative to pressing the send button inside of a text field.
The custom page is then completed by the display of the alarms in real-time refreshable mode (save for the set refresh time).
As regards the jsp page, the only statement required is the inclusion of a **<DIV>** as a marker for where the refresh framework will fill the table of alarms generated by the **XSL** style sheet.

```
<TR>
  <TD colspan="2" align="center" valign="top" style="font-weight: bold;">
    <table width="100%">
      <tr>
        <th>Refreshable alarms</th>
      </tr>
      <TR>
        <TD colspan="2" valign="top">
          <DIV id="alarms"></DIV>
        </TD>
      </TR>
    </table>
  </TD>
</TR>
```

Highlighted in yellow is the line containing the div where framework will enter the result of the XSLT conversion, according to the example provided previously. The result of this operation can be seen in the following figure:



9. DEVICE DETAIL FOLDER

As regards the device detail, the association between DEVICE and FOLDER where the corresponding JSP files are located is described in the following table.

Device description	Folder
pCO air handling unit (FLSTDMAHUA) (>= version 1.8)	ahu_pco_v18
pCO air conditioning unit (EPSTDECZUB)	Cdz_pco
Rack controller v1.8 (FLSTDmFC0A)	CFP_1_8
pCO Rack controller 1/3 compr. (EPSTD*FC2A)	Cfp_ncp
E-drofan 1.8 version	Conv485
E-drofan 1.8 version	edrofan
Energy2	Energy
EVD300 Expansion valve driver	EVD300
EVD400 - Retail Universal	EVD400
pCO Universal stage controller (EPSTDIIU0A)	Insgrd
IR32 V W Z Universal 2 NTC probes	ir32un_t
IR Mpx	irmpx
IR32 M S Y X C for refrigeration	ir_32
IR 33 - C	ir_33_C_v2
MasterCase	MasterCase
MasterCase2	MasterCase2
MasterCella Split	MasterCellaSplit
MasterCella (MTC)	mcella
I/O Module	mio
Modular chiller-HP 1-8 comp. (EPSTDMMCHA)	Mod_ch
Modular chiller-HP with driver (FLSTDMMCDE)	mod_ch_18
Plug-In	plugin
PowerSplit	PowerSplit
pCO Roof-top 1/2 compressors (EPSTDMRT0A)	Rtop_pco
Roof-top 1/2 compressors on pCO1 (FLSTDMRT0E)	Rtop_pCO1_v1_0
Modular Chiller-HP screw compr. (MSCA) - Machine type 0	Screw_Compressor
Cella stagionatura (EPSTDICS00)	Seasoning_room
Shelter on pCO1-2 medium (*MSHE)	shelter_medium
Standard Air-conditioners on pCO1/2 (FLSTDMCZ0E)	std_air_cond
uAC	uAC
uChiller	uChiller
uChiller2 - digital outputs 0	uChiller2
uChiller compact	uChiller_cmp
uRack (MRK)	uRack
Wireless probe	WLProbe

E-drofan 2.0 version	edrofan_20
Service E3 HS10	EVD300_HS_x10
Service E3 HS5	EVD300_HS_x5
IR32 V W Z Universal 1 pressure probe	ir32un_ap
IR32 V W Z Universal 1 humidity probe	ir32un_hu
IR 33 - F	ir_33_F_v2
IR 33 - M	ir_33_M_v2
IR 33 - S	ir_33_S_v2
IR 33 - Y	ir_33_Y_v2
MasterCella (MD33)	mcella_v1
Modular chiller-HP 1-4 comp. (MC0E) - type 0 - master	mod_ch_14_0m
Modular chiller-HP 1-4 comp. (MC0E) - type 0 - slave	mod_ch_14_0s
Modular chiller-HP 1-4 comp. (MC0E) - type 1 - master	mod_ch_14_1m
Modular chiller-HP 1-4 comp. (MC0E) - type 1 - slave	mod_ch_14_1s
Modular chiller-HP 1-4 comp. (MC0E) - type 2	mod_ch_14_2
Modular chiller-HP 1-4 comp. (MC0E) - type 3	mod_ch_14_3
Modular chiller-HP 1-4 comp. (MC0E) - type 4	mod_ch_14_4
Modular chiller-HP 1-4 comp. (MC0E) - type 5	mod_ch_14_5
Power compact - C v.2	pwrCompact_C_v2
Power compact - F v.2	pwrCompact_F_v2
Power compact - H v.2	pwrCompact_H_v2
Power compact - M v.2	pwrCompact_M_v2
Power compact - S v.2	pwrCompact_S_v2
Power compact - Y v.2	pwrCompact_Y_v2
Roof-top 1/2 compressors on pCO2 (FLSTDMRT0E)	Rtop_pCO2_v1_0
Roof-top 1/2 compressors on pCOc (FLSTDMRT0E)	Rtop_pCOc_v1_0
Roof-top 1/2 compressors on pCOxs (FLSTDMRT0E)	Rtop_pCOxs_v1_0
Modular Chiller-HP screw compr. on pCO1/2/c (*MSDE) - type 5	Screw_Cmp0_pCO2
Modular Chiller-HP screw compr. on pCO1/2/c (*MSDE) - type 5	Screw_Cmp1_pCO2
Modular Chiller-HP screw compr. on pCO1/2/c (*MSDE) - type 5	Screw_Cmp2_pCO2
Modular Chiller-HP screw compr. on pCO1/2/c (*MSDE) - type 5	Screw_Cmp3_pCO2
Modular Chiller-HP screw compr. on pCO1/2/c (*MSDE) - type 5	Screw_Cmp4_pCO2
Modular Chiller-HP screw compr. on pCO1/2/c (*MSDE) - type 5	Screw_Cmp5_pCO2
Modular Chiller-HP screw compr. (MSCA) - Machine type 1	Screw_Compressor1
Modular Chiller-HP screw compr. (MSCA) - Machine type 2	Screw_Compressor2
Modular Chiller-HP screw compr. (MSCA) - Machine type 3	Screw_Compressor3
Modular Chiller-HP screw compr. (MSCA) - Machine type 4	Screw_Compressor4
Modular Chiller-HP screw compr. (MSCA) - Machine type 5	Screw_Compressor5
Shelter on pCO1-2 small (*MSHE)	shelter_small
Shelter on pCOxs (*MSHE)	shelter_xs
Standard Air-conditioners on pCOxs (FLSTDMCZ0E)	std_air_cond_pCOxs
uChiller2 - digital outputs 1	uChiller2_1
uChiller2 - digital outputs 2	uChiller2_2
uChiller2 - digital outputs 3	uChiller2_3
uChiller2 - digital outputs 4	uChiller2_4
uChiller2 - digital outputs 5	uChiller2_5
Power analyser	pwr_an
OEM kit KUE	cp
humiFog for AHU/duct	humifog1_1
humiFog for Ambient	humifog1_2
humiSteam	humisteam
gaSteam	gasteam
heaterSteam	heatersteam

10. RELATIONSHIP BETWEEN FILES AND MAPS

The menu on the left is divided into six macro-groups.
Each of these correspond to certain number of sections, each associated with a directory accessible via the following path:

C:\swdept_prj\plantvisorpro\developments\applications\websupervisor\WebRoot\app\NAME

The directory contains the files that correspond to the pages available for each section.

Below is the list of the macro-groups, divided by section, indicating the corresponding directory and the list of JSP files.

10.1 GROUPS

Overall view of the devices with the corresponding settings.

Global → grpview

- Main → subtab1.jsp
- Parameters → subtab2.jsp
- Alarms → subtab3.jsp
- HACCP graph → subtab4.jsp
- Log graph → subtab5.jsp
- Conf Graph → subtab6.jsp

10.2 ALARMS/EVENTS

Macro-group for managing, viewing and looking up alarms and events.

Alarms → alrglb

- Active alarms → subtab1.jsp
- Reset alarms → subtab2.jsp

Events → evnview

- Events → subtab1.jsp

Relays management → relaymgr

- Reset relay → subtab1.jsp

Search → alrevnsearch

- Alarms search → subtab1.jsp
- Events search → subtab2.jsp

10.3 REPORTS

Macro-group for managing the print-outs and saving the alarms and reports.

Periodic print configuration → reportconf

- HACCP → subtab1.jsp
- Log → subtab2.jsp

Print online → report

- HACCP → subtab1.jsp
- Log → subtab2.jsp

Reports archive → hsreport

- Archive → subtab1.jsp

Alarms archive → hsprint

- Archive → subtab1.jsp

10.4 CONFIGURATION

Macro-group for managing the site and the logical configuration of the variables, devices, groups and areas.

Site configuration → siteview

- Site → subtab1.jsp
- New line → subtab2.jsp
- Alarms safety → subtab3.jsp
- Copy config. → subtab4.jsp

Logical configuration → devloglist

- Logical devices → subtab1.jsp

Logical device creation → logicdevice

- Logical devices → subtab1.jsp
- Logical variables → subtab2.jsp

Logical groups → groupview

- Groups list → subtab1.jsp
- New group → subtab2.jsp

Logical areas → areaview

- Areas list → subtab1.jsp
- New area → subtab2.sp

User configuration → setldap

- Users → subtab1.jsp
- Profiles → subtab2.jsp

System pages → mgr

- Information → subtab1.jsp
- System → subtab2.jsp
- IDE → subtab3.jsp
- Support → subtab4.jsp
- guardianPRO → subtab5.jsp
- Notifications → subtab6.jsp
- Plugins → subtab7.jsp

PLUGINS → plugin

- Plugins → subtab1.jsp

10.5 SCHEDULER

Macro-group for creating and managing alarms and events, and the consequent actions with any I/O operations.

Alarms and event management → alrsched

- Rules → subtab1.jsp
- Alarm conditions → subtab2.jsp
- Event conditions → subtab3.jsp
- Time bands → subtab4.jsp
- Actions → subtab5.jsp

Scheduled activities management → actsched

- Rules → subtab1.jsp
- Time bands → subtab2.jsp
- Actions → subtab3.jsp

I/O configuration → setio

- Fax → subtab1.jsp
- SMS → subtab2.jsp
- E-mail → subtab3.jsp
- RAS → subtab4.jsp
- Window → subtab5.jsp
- Relay → subtab6.jsp

I/O test page → testio

- Test I/O → subtab1.jsp

Data transfer → datatransfer

- Data transfer → subtab2.jsp

10.6 MAPS

Macro-group for displaying the devices and the maps created by IDE - LayoutEditor

Devices → deviceview

- Devices → subtab1.jsp

Map list → mstrmaps

- Link maps → subtab2.jsp

11. Custom and logical devices

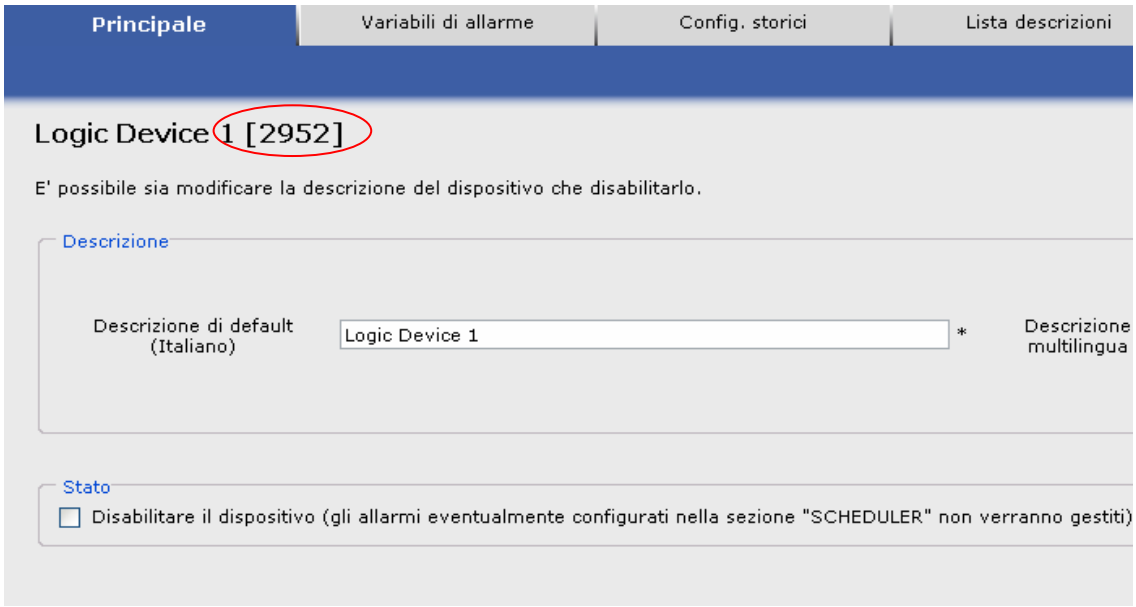
The SDK functions are used to make custom pages even for custom devices created with PlantVisorPRO IDE and for logical devices created in the PlantVisorPRO environment.
The creation of the custom pages using the SDK commands is essentially the same for these types of devices.
The additional operations are slightly different for the custom devices created with IDE and for the virtual devices, and are described below.

11.1 IDE custom devices

When a new device created with PlantVisorPRO IDE is added, the system creates a new directory under
C:\Carel\PlantVisorPRO\engine\webapps\PlantVisorPRO\custom\dtlview
This new directory will have the same name as the XML file for the IDE created device, and even if it is not obligatory it is good practice to name the file based on the code of the device.
The system will use this directory as the reference for the device added, regardless of any other updates.
Example
IDE device
Code: D01
File: device01.xml
Importing the device will create the new directory:
C:\Carel\PlantVisorPRO\engine\webapps\PlantVisorPRO\custom\dtlview\device01
All the files developed in SDK corresponding to the new device will thus be saved in this path.

11.2 Logical devices

The pages created with the logical devices should be located in the following directory:
C:\Carel\PlantVisorPRO\engine\webapps\PlantVisorPRO\custom\dtlview\devicelogic
These must be composed using the logical codes found in the logical device configuration page as references:



In the figure, the ID code of the instrument identifies the custom page inside the file name, as follows
<Device code>_Subtab1.jsp
Example:
2952_Subtab1.jsp

On the other hand, to get the codes of the variables and access the corresponding values, the page with the list of descriptions is used:

Principale
Variabili di allarme
Config. storici
Lista descrizioni
Variabili principali
Logic Device 1
E' possibile modificare le descrizioni di tutte le variabili del dispositivo nonchè la relativa unità di misura.
Inoltre, facendo riferimento all'area a piè di pagina, è possibile inserire/rimuovere unità di misura.
Codice
Descrizioni variabili
Stato del buzzer [191568]
Stato del buzzer da seriale [191569]
Stato del relè1 da seriale [191570]

Example:

```
CurrUnit.getVariable("191568").getDescr1()
```

SDK – Software development kit

1. Introduction to the function

The XML query function is used to access useful information deriving from the field controlled by PlantVisorPRO so as to manage an alternative or complementary external presentation to the one offered by the supervisor.
This function can be used to send, via a packet in standard XML format, a series of requests to the PlantVisorPRO server engine, getting as a response a similar XML packet containing, depending on the type of request sent, data concerning the devices, the parameters associated with a certain device, and alarms.
The response packets can be broken down and analysed so as to be bale to present the data made available by the PlantVisorPRO engine in the most useful way outside of the supervisor web pages.
The following sections of the document will describe the different types of queries available and their use, with details that allow the user to utilise the queries to get the data to be presented in substantially the same way as proposed for presentation by the supervisor.

2. XML Queries

The XML External Query function offers various types of query to retrieve different data from the field controlled by PlantVisorPRO.
This section will first present the query mode, and then analyse the types of query in detail, presenting all the elements that allow the user to exploit the functions provided.

2.1 Query mode

The query mode involves sending a normal http request in secure mode, that is, on port 443 and using https.
The XML query packet is normal standard XML text. An XML query, suitably prepared based on the required type of request, must be forwarded with a https POST request to the following address:

https://<PlantVisorPRO PC IP>/PlanVisorPRO/servlet/MasterXML

The request can reach the server either by sending a form, or for example as an AJAX POST request, or alternatively in any other mode that involves a request of this type and that can subsequently read the response.
An example in Javascript of sending the XML Query and managing the subsequent response using the callback function is shown in the following code:

```
function sendrequest()
{
    if(window.XMLHttpRequest)
        xmlCommReq = new XMLHttpRequest();
    else if (window.ActiveXObject)
        xmlCommReq = new ActiveXObject("Microsoft.XMLHTTP");

    if(xmlCommReq != null)
    {
        try
        {
            xmlCommReq.open("POST",
                "https://<PlantVisorPRO PC IP>/PlantVisorPRO
                /servlet/MasterXML",true);
            xmlCommReq.onreadystatechange = callbackFunction;
            xmlCommReq.send(document.getElementById("input").value);
        }
        catch(e)
        {
            alert("err");
        }
    }
}

function callbackFunction()
{
    if(xmlCommReq.readyState==4)
    {
```

```
        if(xmlCommReq.status==200)
        {
            try
            {
                xmlResponse = xmlCommReq.responseXML;
                txtResponse = xmlCommReq.responseText;
                // --- gestione risposta
                xmlResponse = null;
            }
            catch(e)
            {
                alert("err");
            }
        }
    }
}
```

2.2 Format of the packets

The XML query packets have the following general format:

- Query

```
<requests>                                          ← 1 occurrence
    <login userName="user" password="pwd" />        ← 1 occurrence
    <request type="type" ... >                      ← n occurrences
        <element …/>                                ← n occurrences
    </request>
</requests>
```

The packet must be contained within the <requests> tags, which in turn should contain the access credentials between <login> tags.
A single XML Query can be used to send multiple requests, each enclosed in the <request> tags and with one or more <element> tags, according to the type of request being sent.

- Response from the server

```
<responses>                                         ← 1 occurrence
    <response type="type">                          ← n occurrences
        < - - results - -  />                       ← n occurrences
    </response>
</responses>
```

The <responses> tags contain one <response> occurrence for each <request> sent to the server.
These in turn contain the results corresponding to the request forwarded.

2.3 Query for retrieving the list of devices

This query requests the list of devices configured on the PlantVisorPRO site from the PlantVisorPRO engine.
The XML query packet indicates the list of the devices that needs to be retrieved, while the response packet contains all the information defining a device.

2.3.1 XML query packet

The XML query packet will have the following format:

```
<requests>
<login userName="user" password="password" />
<request type="devicesList" language="language_code" >
<element iddevices="id_devices" />
</request>
</requests>
```

The terms in bold are to be replaced with suitable values, as follows:

- User: PlantVisorPRO user name
- Password: PlantVisorPRO user password
- Language_code: this is a string of characters in XX_xx format, that is, 2 letters in upper case and 2 in lower case separated by an underscore. The groups of 2 letters represent the user language code: for Italian the string will be ***IT_it***. Similarly for the other languages, the code will be made up of 2 letters in upper case, the underscore and then the language code in lower case. This is the standard format that also allows for special dialects, if these are made available in PlantVisorPRO.
- Id_devices: this field is used to indicate which devices the data is required for. The following values are possible:
  - -1: all the devices on the site will be returned
  - List of integers separated by commas (,): the data corresponding to the devices whose identifier is included in the list supplied will be returned; if the identifier does not exist, it will be ignored.

The following example shows a possible XML query packet:

```
<requests>
    <login userName="admin" password="admin" />
    <request type="devicesList" language="IT_it" >
        <element iddevices="212,312" />
    </request>
</requests>
```

2.3.2 XML response packet

The XML response packet to this query will have the following format:

```
<responses>
<response type="devicesList">
    <device
        idDevice="id_device"
        name="description"
        status="status"
        idline="id_line"
        address="address"
        code="code"
        isenabled="enabled"
        comport="com_port"
        baudrate="speed"
        typeprotocol="protocol" / >
</response>
</responses>
```

The values in bold are set on the server side of the query, as follows:

- **Id_device**: unique identifier of the device
- **Description**: description of the device in the set language
- **Status**: integer value that indicates the status of the device. The following values are possible:
  - 0: device not connected
  - 1: device online
  - 2: device with alarm
  - 3: device disabled by the supervisor
- **Id_line**: unique identifier of the line used by the device
- **Address**: serial address that the device is connected to
- **Code**: code of the device (also indicated on the supervisor as the ID); numeric code made up of the progressive number of the line configured in PlantVisorPRO followed by the decimal point and 3 digits that indicate the device serial line number
- **Enabled**: TRUE or FALSE, indicates whether the device is enabled
- **Com_port**: code of the COM port that the device is connected to
- **Baud rate**: device communication speed in baud
- **Protocol**: type of protocol; the following values are currently available in PlantVisorPRO
  - CAREL
  - MODBUS

The following example shows a possible XML response packet:

```
<responses>
<response type="devicesList">
    <device
        idDevice="212"
        name="IR 33 DIN - C - 1"
        status="2"
        idline="112"
        address="1"
        code="2.001"
        isenabled="TRUE "
        comport="COM4"
        baudrate="19200"
        typeprotocol="CAREL"
    />
    <device
        idDevice="312"
        name="Anticondensate controller - GAV"
        status="3"
        idline="212"
        address="1"
        code="3.001"
        isenabled="FALSE"
        comport="COM20"
        baudrate="19200"
        typeprotocol="MODBUS"
    />
</response>
</responses>
```

2.4 Query for retrieving the list of parameters

This query requires the list of parameters corresponding to a certain device from the PlantVisorPRO engine.
The XML query packet indicates the list of the devices in question and if necessary the category of parameters to be retrieved, and in return receives, in the XML response packet, the list of parameters representing the result of the query.

2.4.1 XML query packet

The XML query packet will have the following format:

```
<requests>
    <login userName="user" password="password" />
    <request type="parametersList" language="language_code" >
        <element idDevice="id_device" idsVariable="id_variables" />
    </request>
</requests>
```

The terms in bold are to be replaced with suitable values, as follows:

- User: PlantVisorPRO user name
- Password: PlantVisorPRO user password
- Language_code: this is a string of characters in XX_xx format, that is, 2 letters in upper case and 2 in lower case separated by an underscore. The groups of 2 letters represent the user language code: for Italian the string will be ***IT_it***. Similarly for the other languages, the code will be made up of 2 letters in upper case, the underscore and then the language code in lower case. This is the standard format that also allows for special dialects, if these are made available in PlantVisorPRO.
- Id_device: unique identifier of the device in question
- Id_variables: this field is used to differentiate the query by selecting different categories of parameters according to the value assigned:
    - List of unique numeric variable identifiers, separated by commas: the query will be performed so as to only return the information relating to the requested parameters, and ignoring any inexistent variable identifiers.
    - Value -1: returns the list of all the parameters for the device in question.
    - Value -2: returns the list of t parameters set in the probes area on the device detail page.
    - Value -3: returns the list of parameters set as the main parameter for the device, that is, those visible in the 2 tables on the device detail page, for the read-only and read-write variables respectively.
    - Value -4: returns the list of parameters set in the status area of the device detail. Obviously these variables will all be digital, as a status is on or off by definition.

The following example shows a possible XML query packet:

```
<requests>
    <login userName="admin" password="admin" />
    <request type="parametersList" language="IT_it" >
        <element idDevice="212" idsVariable="800" />
    </request>
</requests>
```

2.4.2 XML response packet

The XML response packet to this query will have the following format:

```
<responses>
<response type="parametersList">
<device name="device_name" iddevice="id_device" >
    <variable
        name="variable_description"
        value="value"
        type="type_variable"
        idvar="id_variable"
        islogic="islogic"
        priority="priority"
        readwrite="read/write"
        minvalue="minimum_value"
        maxvalue="maximum_value"
        shortdescr="short_description"
        longdescr="long_description"
    />
</device>
</response>
</responses>
```

The values in bold are set on the server side of the query, as follows:

- Device_name: text description of the device queried
- Iddevice: unique identifier of the device queried
- Variable_description: text description of the parameter
- Type_variable: integer value that describes the type of parameter value. The following values are possible:
    1. digital value (0 or 1)
    2. analogue value (number with decimal)
    3. integer value (number without decimal)
- Id_variable: unique identifier of the parameter
- Islogic: TRUE or FALSE, indicates whether the parameter is logical, that is, calculated by the supervisor as the result of combining other parameters, or alternatively physical, that is, belonging to the device and read in the field
- Priority: progressive integer that indicates the order of presentation in the device detail in PlantVisorPRO
- Read/write: numeric value that indicates whether the parameter is read-only or read/write:
    - Value =1: the parameter is read-only, not modifiable by the user
    - Value •1: the parameter is read/write
- Minimum_value: minimum value possible for the parameter
- Maximum_value: maximum value possible for the parameter
- Short_description: short text description of the parameter. This is essentially the parameter code, as shown on the instrument
- Long_description: long text description of the parameter. This may contain details on the meaning of the parameter, as well as information on the meaning of the values that can be set.

The following example shows a possible XML response packet:

```
<responses>
<response type="parametersList">
<device name="IR 33 DIN - C - 1" iddevice="212"  >
    <variable
        name="Status of compressor relay"
        value="1.0"
        type="1"
        idvar="800"
        islogic="FALSE"
        priority="5"
        readwrite="1"
        minvalue="0"
        maxvalue="1"
        shortdescr="rl.cmp"
        longdescr=""
    />
</device>
</response>
</responses>
```

2.5 Query for setting the parameters in the field

This query requests the PlantVisorPRO engine to set the value of the parameters in the field.
The XML query indicates the unique identifier of the parameter to be set and the corresponding value.
The response to this type of query involves information on the outcome of the operation.

2.5.1 XML query packet

The XML query packet will have the following format:

```
<requests>
    <login userName="user" password="password" />
    <request type="setParameters" waittime=" wait_time">
        <element idVariable="id_variable" value="value" />
    </request>
</requests>
```

The terms in bold are to be replaced with suitable values, as follows:

- User: PlantVisorPRO user name.
- Password: PlantVisorPRO user password.
- Waittime: waiting time for setting the parameters, in milliseconds. After this maximum time, the parameter is signalled as not having been set, however the parameter may still be set correctly in the next instant.
- Id_variable: unique identifier of the parameter to be set.
- Value: value to be set for the parameter.

The following example shows a possible XML query packet:

```
<requests>
    <login userName="admin" password="admin" />
    <request type="setParameters" waittime="5000" >
        <element idVariable="643" value="1" />
    </request>
</requests>
```

2.5.2 XML response packet

The XML response packet to this query will have the following format:

```
<responses>
    <response type="setParameters">
        <variable id="id_variable" state="status"  />
    </response>
</responses>
```

The values in bold are set on the server side of the query, as follows:

- Id_variable: unique ID of the variable
- Status: outcome of the write operation; the following values are possible
    - ok: parameter set correctly
    - waittime: numeric value of the waittime sent with the request. This means that after having waited the set number of milliseconds, the parameter has still not been modified. This is not an error code but rather a timeout indication. The parameter may still be set to the new value in the next instant
    - error: indicates a error in setting the parameter.

If an internal error occurs on the server, an error packet is returned, with the following format:

```
<responses>
    <response type="setParameters">
        <error />
    </response>
</responses>
```

The following example shows a possible XML response packet:

```
<responses>
    <response type="setParameters">
        <variable id="643" state="ok"  />
    </response>
</responses>
```

2.6 Query on the status of the site

This query requests the status of the site from the PlantVisorPRO engine, that is, whether or not there are alarms.

2.6.1 XML query packet

The XML query packet will have the following format:

```
<requests>
    <login userName="user" password="password" />
    <request type="siteStatus" >
    </request>
</requests>
```

The terms in bold are to be replaced with suitable values, as follows:

- **User**: PlantVisorPRO user name
- **Password**: PlantVisorPRO user password

The following example shows a possible XML query packet:

```
<requests>
    <login userName="admin" password="admin" />
    <request type="siteStatus">
    </request>
</requests>
```

2.6.2 XML response packet

The XML response packet to this query will have the following format:

```
<responses>
    <response type="siteStatus">
        <site id="1" status="site_status" />
    </response>
</responses>
```

The XML response only provides the situation of the queried site:

- **Site_status**: numeric value that represents the status of the site, with 2 possible values
  - 1: site OK
  - 2: site with alarms

The following example shows a possible XML response packet:

```
<responses>
    <response type="siteStatus">
        <site id="1" status="1" />
    </response>
</responses>
```

2.7 Query for retrieving alarms from the field

This query requests the list of alarms from the PlantVisorPRO engine. The XML query may indicate the device/devices required, the maximum length of the list retrieved and the starting point.

2.7.1 XML query packet

The XML query packet will have the following format:

```
<requests>
    <login userName="user" password="password" />
    <request type="alarmList" language="language_code" >
        <element
            idDevice="id_device"
            start="start_list"
            length="length_list"
        />
    </request>
</requests>
```

The terms in bold are to be replaced with suitable values, as follows:

- User: PlantVisorPRO user name
- Password: PlantVisorPRO user password
- Language_code: this is a string of characters in XX_xx format, that is, 2 letters in upper case and 2 in lower case separated by an underscore. The groups of 2 letters represent the user language code: for Italian the string will be ***IT_it***. Similarly for the other languages, the code will be made up of 2 letters in upper case, the underscore and then the language code in lower case. This is the standard format that also allows for special dialects, if these are made available in PlantVisorPRO
- Id_device: unique identifier of the device in question. This attribute can be ignored in the XML query packet, thus retrieving all the alarms from the site.
- Id_variables: this field is used to differentiate the query, selecting different categories of parameters according to the value assigned:
- Start_list: numeric value that is used to skip the first *n* alarms in the list.
- Length_list: used to specify the number of alarms to be retrieved.

The following example shows a possible XML query packet:

```
<requests>
    <login userName="admin" password="admin" />
    <request type="alarmList" language="IT_it" >
        <element start="0" length="10"/>
    </request>
</requests>
```

2.7.2 XML response packet

The XML response packet to this query will have the following format:

```
<responses>
    <response type="alarmList">
    <alarm
        name="alarm_description"
        starttime="time_start"
        endtime="time_end"
        ackuser="user_acknowledge"
        acktime="time_acknowledge"
        deluser="user_cancel"
        deltime=" time_cancel "
        resetuser="user_reset"
        resettime="time_reset"
        iddevice="id_device"
        devicedescription="device_description "
        idalarm="id_alarm"
        idvariable="id_variable"
        priority="priority"
        islogic="logic"
    />
    </response>
</responses>
```

The values in bold are set on the server side of the query, as follows:

- **Alarm_description**: text description of the alarm
- **Time_start**: instant the alarm started
- **Time_end**: instant the alarm ended, null if still active
- **User_acknowledge**: user who acknowledged the alarm
- **Time_acknowledge**: instant the alarm was acknowledged
- **User_cancel**: user who cancelled the alarm
- **Time_cancel**: instant the alarm was cancelled
- **User_reset**: user who reset the alarm
- **Time_reset**: instant the alarm was reset
- **Id_device**: identifier of the device with the alarm
- **Device_description**: text description of the device with the alarm
- **Id_alarm**: identifier of the alarm
- **Id_variable**: identifier of the alarm variable
- **Priority**: indicates the priority of the alarm, and have 4 different values, according to the language used, which in English are:
  - Highest
  - High
  - Medium
  - Low
- **Logic**: string value, TRUE or FALSE, that indicates whether or not the alarm is logical.

If some of the fields are not available, for example, the alarm end time or the users and times of the various operations, this will be given null values.

The following example shows a possible XML response packet:

```
<responses>
   <response type="alarmList">
   <alarm
      name="No connection"
      starttime="2007-06-15 16:17:44.234"
      endtime=""
      ackuser=""
      acktime=""
      deluser=""
      deltime=""
      resetuser=""
      resettime=""
      iddevice="212"
      devicedescription="IR 33 DIN - C - 1"
      idalarm="3017"
      idvariable="739"
      priority="HIghest"
      islogic="FALSE"
   />
   </response>
</responses>
```

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